

Immersive virtual reality increases liking but not learning with a science simulation and generative learning strategies promote learning in immersive virtual reality.

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Abstract

We investigated the instructional effectiveness of using an interactive and immersive virtual reality (IVR) simulation versus a video for teaching scientific knowledge in two between-subject experiments. In Experiment 1, 131 high school students (84 females) used a science simulation that involved forensic analysis of a collected DNA sample in a virtual laboratory environment rendered in IVR or as a video covering the same material. In Experiment 2, 165 high school students (111 females) replicated the experiment with approximately half of each group being asked to engage in the generative learning strategy of enactment after the lesson-i.e., carrying out the learned procedures with concrete manipulatives. Across both experiments, the IVR groups reported significantly higher perceived enjoyment and presence than the video group. However, no significant differences were found between media for procedural knowledge in Experiment 1 and 2, or transfer in Experiment 2. Also, there was no difference in declarative knowledge across media in Experiment 1, and there was a media effect favoring video in Experiment 2 ($\eta^2 = 0.028$). Enactment lead to significantly better procedural knowledge ($\eta^2 = 0.144$) and transfer ($\eta^2 = 0.088$) in the IVR group but not in the video group. In conclusion, learning in IVR is not more effective than learning with video but incorporating generative learning strategies is specifically effective when learning through IVR. The results suggest that the value of IVR for learning science depends on how it is integrated into a classroom lesson.